ments carried on last spring. In tabulating the results those cards showing defects of less than fifteen per cent. from the normal were thrown out, as it had been found that an almost imperceptible decrease in the amount of light had a comparatively great effect on the result and consequently these cards were within the limits of error. A cloudy day likewise caused the percentage to drop, as did also fatigue. In sorting the cards after this elimination, it was found that out of 793 boys 308 or 38.84%, and out of 602 girls 313 or 52% were short-sighted.

The cards were now arranged according to the school-grades. In the first two grades the percentage of defective eyes is lower for girls than for boys, but in the others the reverse is the case. On the other hand the results vary from grade to grade. Both boys and girls start with a low per cent., 35, for the boys and 31.4 for the girls. In the next two grades a great increase is observed, the figures being 52.7% and 67% for boys and girls respectively. In the fourth grade there is a drop to 38% and 48.9% respectively, in the fifth a slight increase to 41.6% and 51% and then a steady decline to the ninth grade, where it is 18% for the boys and 24% for the girls.

The importance of this fact lies in its bearing on the question of the influence of growth on the susceptibility to disease. This rapid decrease in the percentage of defective eyes corresponds in time with the acceleration of growth attendant on the period of adolescence. It has generally been supposed that this increased rapidity of growth is attended by an increased susceptibility to disease and injury, but the observations made by Dr. Axel Key in the Swedish schools seem to completely refute this idea. He found that at no time were children better able to withstand disease than at this period, while before and after it they were especially susceptible. The decrease in the percentage of defective eyes at this period may be accounted for on the same ground.

The cards were also sorted with respect to the amount of weakness of sight found in each sex and finally with respect to the amount of weakness displayed by each of the eyes. Among the boys 46.5% were between 0.62 and 0.85 of the normal strength, 24.2% were between 0.50 and 0.62 of the normal, while 30.25% were below this. Among the girls the percentages were 47.8%, 24.25% and 28% respectively. Among the boys both eyes were defective in 53.77%, the right eye in 19.6% and the left eye in 26.63% of the cases. For the girls the figures were 56.58% for both eyes, 20.55% for the right eye and 22.86% for the left eye. From this it would seem that the left eye in both sexes is more likely to be defective than the right eye and in boys more often than in girls. Among boys the defects seem to be more serious in a larger number of cases.

The instruments used in the tests were the Snellen test-types for the first five grades and the Galton eye-test for the other grades. The use of the former was necessary in the lower grades on account of the youth of the children. The variation between the results of the two instruments falls within the limit of error for fatigue or change of illumination and so has no influence on the results as reckoned above.

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REACTION.

KÜLPE UND KIRSCHMANN. *Ein neuer Apparat zur Controle zeitmessender Instrumente.* Beschrieben von O. Külpe und A. Kirschmann. Phil. Stud., 1892, VIII. 145-172.

TITCHENER. *Zur Chronometrie des Erkennungsactes.* Phil. Stud., 1892., VIII., 138-144.

Dr. Külpe and Dr. Kirschmann describe an instrument devised by Prof. Wundt to regulate the Hipp electric chronoscope. It is now

recognized by psychologists (though apparently not yet discovered by physicists) that the chronoscope only gives correct times when the relative strength of the current and spring are so adjusted that the latent times in drawing up and releasing the armature are alike. The chronoscope is empirically regulated by measuring a standard interval of time, and adjusting the current and spring until the chronoscope gives this time correctly. Prof. Wundt has constructed a large falling hammer with a lever and weight, which give times up to 616σ. The time required for the hammer to fall cannot be calculated theoretically and can scarcely be measured with a tuning fork, but may be determined with a chronograph. According to the tests made by Külpe and Kirschmann the mean variation of the hammer as tested by the chronograph was on the average 1.04σ. This includes the variable error of the chronoscope, but not the constant error which would be carried over to the chronoscope. The variable error of the chronoscope and hammer combined was on the average 1.04σ, which may be regarded as exactly the same as before. The variable errors of the chronograph used at Leipzig and of the chronoscope are consequently alike, which is contrary to Wundt's statement: "Die Feinheit und Genauigkeit ist also hier (with the chronograph) eine reichlich zehmal so grosse als bei dem Hipp schen chronoskop." (Phys. Psy. II., 282.) Külpe and Kirschmann find the error of the chronoscope to be much greater when the hammer is placed in a secondary circuit. A secondary circuit is necessary in measuring reactions with the old form of the chronoscope, and this should consequently be discarded. The constant error of the chronoscope used at Leipzig was found to be over two and a half per cent of the time, and this correction should probably be made in researches from the Leipzig laboratory, in which this chronoscope has been used. The chronoscope may, however, be readily regulated so as to have an error less than one-fourth of one per cent. Külpe and Kirschmann find that the time the current is broken does not appreciably affect the latent time of magnetism, consequently if the chronoscope be regulated for a standard time, say 100σ, longer times will also be measured correctly. The old form of the chronoscope (in which the hands run while the circuit is broken) was used in these experiments, and they should be repeated with the newer and more convenient form, in which the hands may be made to run while the circuit is closed.

Mr. Titchener gives the results of experiments in which the distinction between muscular and sensory reactions was used to determine the time of perception. The paper is the first part of a research concerned with the time of association. It is maintained by Wundt that if in reacting an observer in one case direct his attention to the movement and in another to the stimulus, the difference in time will give the time required to perceive the stimulus. On this supposition Titchener obtained the following times (in thousandths of a second) for three observers.

Excess in time of sensory over muscular reactions.		
81.4	84.4	97.
Perception-time for a color.		
29.5	30.2	28.1
Perception-time for a letter.		
53.5	52.7	51.5
Perception-time for a short word.		
51.8	50.1	45.3

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